Draft

Living With a Star (LWS) Program

GUIDELINES AND CRITERIA FOR THE Geospace-Related Missions of Opportunity PHASE A CONCEPT STUDY

September 8, 2006

GUIDELINES AND CRITERIA FOR THE PHASE A CONCEPT STUDY

INTRODUCTION

The Geospace-Related Missions of Opportunity (GMO) Announcement of Opportunity (AO) proposals that were selected pending the outcome of the Phase A study will conduct a concept study to better define the investigation, its implementation requirements (both engineering and management), and its risks. The concept study will constitute the investigation's requirements definition phase (Phase A) of the formulation subprocess as outlined in NPR 7120.5C, *NASA Program and Project Management Processes and Requirements.* Upon completion of the concept study, proposers will submit a Concept Study Report (CSR) for NASA evaluation. The CSR is to be a self-contained document; that is, selected investigators must not assume that NASA evaluators will have reviewed or even have access to the original proposal.

The concept study will constitute the investigation's requirements definition phase (Phase A) of the formulation subprocess as outlined in NPR 7120.5C, *NASA Program and Project Management Processes and Requirements.*

The CSR is due by 4 pm Eastern time, **September 12, 2007**, at

LWS Mission of Opportunity
Science Mission Directorate
NASA Research and Education Support Services (NRESS)
500 E Street, SW, Suite 200
Washington, DC 20024
Tel: 202-479-9030

Please note that all program constraints, guidelines, definitions, and requirements given in the AO are still valid for the CSR except as noted herein.

Part I of this document discusses the criteria to be used by NASA for the evaluation of the CSR's. Part II provides guidance for preparation of the CSR's. Appendix A provides definitions of cost element terms used in the cost plan section of this document.

Phase A Study Activities and Support

After the Phase A Concept Study has been submitted, the NASA evaluation team of the Phase A Concept Study Report will conduct a site visit for each proposed Mission of Opportunity. The timing of these site visits will be several weeks after the Phase A Concept Study reports are due and will be approximately one day in length. The specific date of the site visit will be set with at least three months advance notice.

PART I - EVALUATION CRITERIA

The NASA evaluation of the Concept Study Reports will be conducted in much the same fashion as the evaluation of the proposals as discussed in Section 7.0 of the AO. However, in addition to considering any changes to the science objectives from those in the Step 1 proposal, this evaluation will consider in detail all factors related to the probability of investigation success and to the realism of the proposed costs to NASA. Education and public outreach is not an evaluation factor.

Successful implementation of the GMO investigations demands, in addition to scientific merit, that the investigation be achievable within the established constraints on cost and schedule. The information requested in Part II of this document will enable the evaluation panel to determine how well each investigation team understands the complexity of its proposed investigation, its technical risks, and that weaknesses have been retired or have specific actions identified and planned during Phase B.

The criteria for evaluating the concept study are as follows:

a. Scientific merit.
b. Scientific Implementation merit, including Technical Merit.
c. Technical, Management, and Cost (TMC)

Scientific Merit and Scientific Implementation Merit, Including Technical Merit

The first two criteria are the same as described in Section 7.2 of the AO. The science objectives must not change from those given in the proposal. Any changes to science implementation will be carefully evaluated. If there are no substantive changes in the science implementation, then the scientific merit of the proposed investigation (first criterion) and the scientific implementation merit of the proposed investigation (second criterion) will not be reevaluated. In this case, the evaluations of scientific merit and of scientific implementation merit of the original proposal will be used.

Assuming that there are no changes to the proposed science or its implementation, the emphasis of the evaluation will be on the technical, management, and cost feasibility, including cost risk, of the proposed investigation (third criterion). Total cost to NASA SMD will be a selection but not an evaluation criterion.

Technical, Management and Cost

The information requested in Part II of this document will be used to evaluate each investigation in detail for the feasibility of investigation implementation as reflected in the perceived risk of accomplishing the investigation within proposed resources. The Technical, Management, and Cost criteria in the AO will be supplemented with the following considerations:

The technical and management approaches will be evaluated to assess the likelihood that the investigation can be implemented as proposed. This will include an assessment of the risk of completing the investigation within the proposed cost. It will also consider the adequacy of the proposed approach, the organizational structure, the roles and relevant experience and past performance of the proposer and partners, the management approach, the commitments of partners and contributors, and the team's understanding of the scope of work (covering all elements of the investigation, including contributions). The experience and expertise of the development organizations will be factors in assessing the probability of success. The relationship of the work to the project schedule, the project element interdependencies, and associated schedule margins will also be evaluated. The proposal must discuss the methods and rationale (cost models, cost estimating relationships of analogous investigations, etc.) used to develop and validate the estimated cost and must include a discussion of cost risks. Innovative cost effective features, processes, or approaches will be rewarded if proven sound.

The evaluation will consider the proposer's understanding of the processes, products, and activities required to accomplish development of all elements (e.g., multiple instruments, ground and data systems, etc.), the integration of all elements, and the adequacy of the proposed approach including reserves and margins. The technical approach will be examined in its entirety to ensure that: (1) all elements and processes are addressed, (2) weaknesses and design issues are understood and plans for resolution have been identified, (3) fundamental design trades have been identified and studies planned, and (4) primary performance parameters have been identified and minimum thresholds established. GFE, as defined in the AO, will be assessed to verify that it is being used within its intended capability. The overall approach (including schedule), the specific design concepts, and the known hardware/software will be evaluated for soundness, achievability, and maturity. Resiliency and design performance margins will be factors in this evaluation. When new technology and/or systems at low Technology Readiness Levels (TRL) are proposed, proposers must provide detail development plans that will achieve TRL 6 by the end of Phase B (see the TRL definition chart on Appendix C of the AO). Investigations proposing new technology or systems at low Technology Readiness Level (TRL) will be assign higher risk ratings if adequate backup plans to ensure success of the mission are not described.

The credibility and realism of the cost estimates and the planned financial resiliency will be evaluated. The underlying rationales for the cost estimates, including reserves, and the development schedule, including schedule margins, will be factors in this evaluation. The adequacy of reserves, in the context of the recommendations of the NASA Integrated Action Team (NIAT), are also factored into this evaluation.

The information provided in the Management section must demonstrate the proposer's plans, processes, tools, and organization for managing and controlling the development and operation of the instrument(s), including performance measurement and reporting. The soundness and completeness of the approach and the probability that the management team can assure mission success will be evaluated by reviewing the organizational structure (including roles, responsibilities, accountability, and decision making process) and the processes, plans, and strategies the team will use to manage the various investigation elements through all phases of the mission. Factors in this evaluation will include: clear lines of authority, clean interfaces, prudent

scheduling and cost control mechanisms, review processes, and demonstrated awareness of all necessary management processes. The adequacy with which risk management activities are planned and budgeted incorporating the recommendations of the NASA Integrated Action Team (NIAT) Report, are also factored into this evaluation. Additional factors in the evaluation of the probability of investigation success will include the experience, expertise, and commitment of key personnel and the organizations to which they are attached, the adequacy of facilities and equipment proposed for the mission, the adequacy of the team's approach to risk management, and the adequacy of the management and control mechanism. Innovative management processes and plans will be rewarded if proven to be sound.

The completeness of the Phase B plans will be considered in determining the adequacy of the Phase B approach. This will include an evaluation of the activities/products, the organizations responsible for those activities/products, and the schedule to accomplish the activities/products.

PART II - REQUIRED QUANTITIES, MEDIA, FORMAT, AND CONTENT

Forty (40) paper copies of the Concept Study Report are required. An additional twenty five (25) copies of the Fact Sheet (see Section C, below) are required. It is required that each paper copy of the CSR be accompanied by a CD containing an electronic version of the CSR in a single file to facilitate searching for specific information (the PDF format is preferred) that is readable by a PC and a Mac computer. The PDF document must be searchable and bookmarks must be used to outline major sections of the document.

Proposers must also submit the data in cost tables as separate files. Each of these cost tables, including the headings for the rows and columns, must be in a tab-delimited text file. Optionally, versions of these files in Excel can also be included. Each CD that will accompany the original or a copy of the CSR must include the required files. These CD's and the files in them must be compatible with both PC's and Mac's. The required uniform format and contents are summarized below. Failure to follow this outline may result in reduced ratings during the evaluation process.

If beneficial to the understanding of potential data products or mission operation concepts, the CD may include a small number of simple simulations, e.g. QuickTime movies, that are referenced and described in the CSR. Other than these simulations, do not include any other information on the CD that is not included in the paper volumes of the Concept Study Report.

When changes have been made to any data provided with the original proposal as a result of the concept study, these changes from the proposal must be clearly identified. The content of each requirement is discussed in the subsequent paragraphs. Note that all program constraints, guidelines, requirements, and definitions given in the AO are still valid for the Concept Study Report except as noted herein.

The CSR shall contain no more than 138 (section B-I) pages, including no more than seven foldout pages (28 x 43 cm; i.e., 11 x 17 inches). Three-ring binders may be used.

- A foldout page counts as one page
- All pages other than foldout pages shall be 8.5 x 11 inches
- Single- or double-column format is acceptable.
- In complying with the page limit, no page may contain more than 55 lines of text and the type font must not be smaller than 11-point except within figures and tables, where the type font must not be smaller than 9-point.

The following page limits apply:

Section	Page Limit
A. Cover Page and Investigation Summary	No page limit, but be concise
B. Table of Contents	2
C. Fact Sheet	2
D. Executive Summary	5
E. Science Investigation (changes highlighted)	30, plus 8 pages per additional instrument if a suite of instruments is proposed)
F. Technical Approach and Mission Design G. Management Plan H. Education and Public Outreach I. Phase B Plan	75
J. Cost Plan for Phases A through E	No page limit, but data must be presented in formats described; be brief
K. Appendices (No other appendices permitted) 1. Letters of Endorsement 2. Relevant Experience and Past Performance 3. Resumes 4. Statement(s) of Work for Each Contract Option 5. Data Management Plan 6. Any Incentive Plan(s) 7. Any NASA PI Proposing Team 8. Technical Content of Any International Agreements 9. Discussion on Compliance with U.S. Export Laws and Regulations – Update from Proposal 10. Science Level 1 Requirement 11. Acronyms List 12. Reference List (Optional)	No page limit, but small size encouraged

A. COVER PAGE AND INVESTIGATION SUMMARY

A Cover Page and Investigation Summary must be a part of the proposal, but will not be counted against the page limit. It must be signed by the Principal Investigator and an official of the investigator's organization who is authorized to commit the organization. Create a custom cover page, which contains the following information. The full names of the Principal Investigator and the authorizing official, their addresses with zip code, telephone and fax numbers, and electronic mail addresses, are required, as well as the names, institutions, and E-mail addresses of all participants, the type of investigation proposed, the total NASA SMD Cost, and a 200-word Summary. A hard copy version of this Cover must be printed in time to acquire signatures and include with the original hard copy of the CSR.

B. TABLE OF CONTENTS

The CSR shall contain a table of contents that parallels the outline provided in Sections C through K below.

C. FACT SHEET

A Fact Sheet that provides a brief summary of the proposed investigation must be included. The information conveyed on the Fact Sheet must include the following: science objectives (including the importance of the science to the NASA Heliophysics science theme), investigation overview (including investigation objectives and major mission characteristics), science payload, , investigation management (including teaming arrangement as known), schedule, and cost estimate. Other relevant information, including figures or drawings, may be included at the proposer's discretion. The Fact Sheet is restricted to two pages (preferably a double-sided single sheet).

D. EXECUTIVE SUMMARY

The Executive Summary is to be a summary of the contents of the CSR and is to include an overview of the proposed baseline investigation including its scientific objectives, the technical approach, management plan, cost estimate, and small disadvantaged business plans. The Executive Summary must not exceed 5 pages in length.

E. SCIENCE INVESTIGATION

This section shall describe the science investigation resulting from the Concept Study. Any descoping of, or changes to, the investigation from the baseline and minimum mission science defined in the proposal must be identified and the rationale for the change(s) given. Changes may be highlighted in bold with column marking for easy identification or may be provided in a change matrix giving the original (proposed) requirement, the new requirement, rationale for the change, and its location within the CSR. If there are no changes, this section must be repeated identically from the proposal with a statement that there are no changes.

Special attention must be given to assuring that both the planning and resources are adequate to analyze, interpret, process, and archive all the data produced by the investigation in the appropriate data archive. Resources include cost, schedule, and work-hours for scientific interpretation of results and publication.

It is expected that modifications will be required in the description of the science implementation, especially as relates to the criterion for feasibility. A page quota larger than that in the step 1 proposal has been allotted for this purpose.

F. TECHNICAL APPROACH

The Technical Approach section must detail the method and procedures for investigation definition, design, development, testing, integration, ground operations, and flight operations. A discussion of all new/advanced technologies planned for the investigation must be provided and include backup plans with scheduled decision criteria if those technologies cannot be made ready. This section must also detail the expected products and end items associated with each phase. Investigation teams have the freedom to use their own processes, procedures, and methods. The use of innovative processes, techniques, and activities by mission teams in accomplishing their objectives is encouraged when cost, schedule, technical improvements, and risk containment can be demonstrated. The benefits and risks, if any, of any such processes and products must be discussed. This section must be complete in itself without the need to request additional data, although duplications may be avoided by reference to other sections of the CSR if necessary.

1. Technical Approach Overview. This section must provide a brief overview of the technical approach including its key challenges.

2. Science Payload. This section must describe the science payload for the investigation in detail. Highlight any changes to the payload or individual instruments or their performance since submission of the proposal. A clear plan for the accommodation of the instrument(s) on the host vehicle must also be included. Subsystem characteristics and requirements must be described. Such characteristics include: mass, volume, and power requirements; pointing requirements; new developments needed; and a space qualification plan. Include where appropriate: block diagrams, lower-level mass breakouts listing major components (master equipment list – see a sample master equipment list in Figure 8) layouts, calibration plans (before and/or during operations), operational and control considerations, and software development. Any design features incorporated to effect cost savings must be identified. A summary of the resource elements of the instrument design concept, including key margins, must be provided. The rationale for margin allocation must be provided. Those design margins that are driving costs must be identified. Reference may be made to Section E of the CSR to avoid duplication. Discussions of the plans for new technology and back-up alternatives must be discussed. SMD requires all enabling technology required must be at TRL 5 or higher before a project may enter phase B. Also, all enabling technology must be at TRL level 6 or beyond to transition from phase B to C (Formulation to Implementation). It is therefore

imperative that detail development plans are provided to advance low TRL technologies to TRL ≥6 at the end of phase B and/or provide evidence of maturity for technologies currently at TRL ≥6. Investigations proposing new technology or systems at low TRL will be assign higher risk ratings if adequate backup plans to ensure success of the mission are not described. Heritage claims for technologies must be substantiated. If the instrument or components from which heritage is claimed, were developed and implemented by an institution and/or by a team other than the proposing institution and/or team, explain how this heritage is applied and lessons learned incorporated. Instrument performance claims must be clearly substantiated.

3. Science Impacts on Mission Operations. This section should fully describe the science requirements that impact the operational phase of the mission. It should include information on science requirements that may affect the proposed launch date, and launch window constraints (if any). An observation plan to maximize science return (particularly for multiple instruments) must be presented.

4. Host Vehicle Accommodations. This section must describe in detail the accommodations required of the host vehicle and, as appropriate, the manufacturing facility to support the instrument(s). A "traceability matrix" showing how the proposed instrument accommodations comply with the stated objectives, requirements and constraints of the proposed investigation must be included. The instrument accommodations must include a discussion of all instrument(s) requirements that impact the various host vehicle subsystems, including attitude control (pointing, pointing stability, spin rate, etc), mechanical (individual mass and mass margins, mounting constraints, co-alignment requirements between instruments of the instrument suite, etc.), C&DH (peak and average data rates with margins, daily data volume, timing requirements within and between spacecraft, etc.), power and power margins (peak, average and survival & operational heater power, etc.), thermal (operational and survival, etc.), and propulsion (contamination sensitivity, etc.). Requirements for host vehicle simulators should be stated, if there are such requirements.

5. Major Host Vehicle Trades. This section should discuss the major trades between the instruments and the host vehicle. The criteria for the final choices should also be presented. This section should include an overall proposed architecture for the instrument(s), including describing interdependencies of the instrument(s) hardware. If there are major departures from the selected proposal, they should be explained here. This section should also describe the future areas for trades between the instrument(s) and the host vehicle.

6. Fabrication and Test. Discuss the manufacturing strategy to produce, test, and verify the hardware/software necessary to accomplish the science goals of the instrument(s). Include a description of the main processes and procedures planned in the fabrication of flight hardware, software, production personnel resources, incorporation of new technology/materials, and the preliminary test and verification program. Provisions and facilities required to produce a set of one or more instruments, as appropriate, should be

described. Discuss past experience, if any, at producing identical sets of instruments. If the fabrication and test procedures from which heritage is claimed were developed and implemented by an institution and/or team other than those proposing, explain how this heritage is applied and lessons learned incorporated. Describe plan to manufacture identical instruments, and workforce plan to staff fabrication of identical sets of instruments. Discuss how the fabrication flow will support the project schedule. A description of the approach for transitioning from design to manufacturing should be included. The ability to assure reproducibility and adequacy of tooling availability should be addressed.

7. Integration and Test. The applicable environmental tests planned should be discussed in detail, and proposed test margins and durations for the environmental test program described. The approach, techniques, and facilities planned for integration, test and verification, and launch operations phases (including launch site testing and processing), consistent with the proposed schedule and cost, should be described. A preliminary schedule for manufacturing, integration, calibration and test activities should be included. A description of the planned end items, including engineering and qualification hardware, should be included.

8. Calibration and Inter-calibration. This section should describe the approach to calibrating, and inter-calibrating the instruments. Pre-launch and post-launch calibrations should be discussed. Any activities and constraints that will impact on the observatory level processing (e.g. removal of instruments after observatory environmental test) should be discussed. Any activities that impact on mission operations (e.g. changing observatory orientation) after launch should be discussed.

9. Science Data Analysis. Data analysis methods and algorithms must be described. Their development should be discussed including resource allocation schedule, and documentation.

10. Instrument Operations. This section should discuss any pre-planned campaigns, which include science requirements for observing modes, regions of interest, orientation, and maintenance. The planned approach for managing instrument operations and all flight operations support, including inputs to mission planning and scheduling, instrument command sequence generation, and data analysis should be discussed. A discussion of the system by which the instrument operations will be modified during the mission should be included. Describe all inter-facility communications, computer security, or near real-time ground support requirements, and indicate any special equipment or skills required of ground personnel. The Level 1 data products, software tools, and the timeframe they will be made available to the science community should also be discussed.

11. Facilities. Provide a description of any new, or modifications to existing, facilities, laboratory equipment, and ground support equipment (GSE) (including those of the team's proposed contractors and those of NASA and other U.S. Government agencies) required to execute the investigation. The outline of new facilities and equipment must

also indicate the lead-time involved and the planned schedule for construction, modification, and/or acquisition of the facilities.

12. Mission Assurance, Reliability and Safety. This section should describe the process by which product quality is assured to meet the NASA mission specifications, including identification of trade studies, the parts selection strategy, and the plans to incorporate new technology. Further information on the mission assurance requirements is detailed in the "Geospace Mission Assurance Requirements (MAR)", which is available from the proposal web library (http://sso.larc.nasa.gov/rbsp/rbsplib.html). This section should also describe any waivers to the requirements of the MAR that the team plans to submit. Also include plans for problem/failure reporting, inspections, quality control, parts selection and control, reliability, safety assurance, and software validation.

13. Adherence to Accepted Management Processes and Practices. The CSR must encompass all technical aspects of the investigation from Phase B through delivery of the data to the PDS and their analysis during Phase E. The document NPR 7120.5C, *NASA Program and Project Management Processes and Requirements,* delineates activities, milestones, and products typically associated with Formulation and Implementation of projects and may be used as a reference in defining a team's mission approach. NPR 7120.5C may be found in the LWS Geospace Library. All missions must adhere to NPR 7120.5C in order to receive approval for implementation, that is, the initiation of Phase C through a NASA/SMD Confirmation process.

    While mission teams have the freedom to use their own processes, procedures, and methods to meet the requirements of NPR 7120.5C, they must plan to obtain Independent Verification and Validation (IV&V) from the NASA IV&V Facility in Fairmont, West Virginia, for all flight and ground software. IV&V must be accomplished in accordance with NPD 2820.1C, *NASA Software Policy* (found in the RBSP Library). The NASA IV&V Facility provides an online self-assessment process, available at http://ivvcriteria.ivv.nasa.gov/, as a starting point for the CSR team to understand the risk and specific software development characteristics of their mission. Each CSR team must verify that they will obtain IV&V services from this NASA Facility. Note that this IV&V is not intended to substitute for good practices in software verification and validation performed by the project. NASA covers the cost of these required IV&V activities.

    Each investigation shall have a cost-effective mission assurance program that is consistent with the AS9100 Quality Systems Aerospace Model for Quality Assurance in Design, Development, Production, Installation and Servicing. AS9100 compliance assessment and registration coupled with ISO 9001 registration is highly encouraged. Safety and reliability are vital, and the quality systems that we use to ensure that safety and reliability are critical to our mission success. AS9100 is the Quality Systems Aerospace Model for Quality Assurance in Design, Development, Production, Installation and Servicing. AS9100 includes ASQ9001:2000 quality system requirements and specifies additional aerospace industry requirements for a quality system. AS9100 places additional emphasis on structured design, control of software and design validation methodologies that are

needed for NASA systems quality application. Additional quality systems requirements will include specific clauses for sharing of quality data, configuration management, reliability, maintainability, and safety.

Manufacturers, suppliers and service organizations that regard quality management as a key business driver are highly desired as NASA hardware and service providers. Independent AS9100 and ASQ9001:2000 registration provides objective evidence of a commitment to quality, safety and reliability. NASA expects conformance to AS9100 and to the applicable derivatives such as AS9110 for Repair and Overhaul facilities and AS9120 for Pass-through Aerospace Distributors. Certification to the AS9100 though the Industry Controlled Other Party (ICOP) process is strongly encouraged.

G. MANAGEMENT PLAN

This section sets forth the investigator's approach for managing the work, the recognition of essential management functions, and the overall integration of these functions. This section must specifically discuss the decision-making process to be used by the instrument team, focusing particularly on the roles of the Principal Investigator and Project Manager in that process. The management plan gives insight into the organizations proposed for the work, including the internal operations and lines of authority with delegations, together with internal interfaces and relationships with NASA, major subcontractors, and associated investigators. It also identifies the institutional commitment of all team members, and the institutional roles and responsibilities. The use of innovative processes, techniques, and activities by instrument teams in accomplishing their objectives is encouraged; however, they must be employed only when cost, schedule, or technical improvements can be demonstrated and specific enabling assumptions are identified.

1. Team Member Responsibilities. This section must describe the roles, responsibilities, time commitment, and experience of all team member organizations and key personnel, with particular emphasis placed on the responsibilities assigned to the Principal Investigator (PI), the Project Manager, and other key personnel. In addition, information must be provided which indicates what percentage of time key personnel will devote to the mission, the duration of service, and how changes in personnel will be accomplished.

    a. Organizational Structure. The management organizational structure of the investigation team must be described in the CSR. A Work Breakdown Structure (WBS) must be provided. The CSR must describe the responsibilities of each team member organization and its contributions to the investigation. Each key position, including its roles and responsibilities, how each key position fits into the organization with clear lines of authority, and the basic qualifications required for each position, must be described. A discussion of the unique or proprietary capabilities that each member organization brings to the team, along with a description of the availability of personnel at each partner organization to meet staffing needs must be included. The contractual and financial relationships between team partners must be discussed. An example of a WBS is included in the LWS Geospace online library.

Summarize the relevant institutional experience in this section, and refer to supporting detail included in Section K2, Relevant Experience and Past Performance. If experience for a partner is not equivalent to, or better than, the requirements for the proposed investigation, explain how confidence can be gained that the investigation can be accomplished within cost and schedule constraints.

b. Experience and Commitment of Key Personnel. Provide a history of experience explaining the relationship of the previous experience to each key individual's role; include the complexity of the work and the results.

i. Principal Investigator. The role(s), responsibilities, and time commitment of the Principal Investigator must be discussed. Provide a reference point of contact, including address and phone number.
ii. Project Manager. The role, responsibilities, time commitment, and experience of the Project Manager must be discussed. Provide a reference point of contact, including address and phone number.
iii. Other Key Personnel. The roles, responsibilities, time commitments, and experience of other key personnel in the investigation including Co-Investigators must be described. Those investigations that include Co-Is or other key personnel that are not identified as having key specific responsibilities will be penalized.

2. Management Processes and Plans. This section must describe the management processes and plans necessary for the logical and timely pursuit of the work , accompanied by a description of the work plan. This section must also describe the proposed methods of hardware and software acquisition. The management processes which the investigator team proposes, including the relationship between organizations and key personnel must be discussed, including the following, as applicable: systems engineering and integration; requirements development; configuration management; schedule management; team member coordination and communication; progress reporting, both internal and to NASA; performance measurement; and resource management. This discussion must include all phases of the mission including preliminary analysis, technical definition, the design and development, descope concepts and instrument operations phases, along with the expected products and results from each phase. Unique tools, processes, or methods, which will be used by the investigation team, must be clearly identified and their benefits discussed. The philosophy to be used for spares should be defined and discussed. All project elements must be covered to assure a clear understanding of project-wide implementation.

3. Schedules. The schedule and workflow for the complete mission life-cycle must be clearly defined, and the method and tools to be used for internal review, control, and direction discussed. Schedules for all major activities, interdependencies between major items, deliveries of end items, critical paths, schedule reserves and margins, and long-lead

procurement needs (defined as hardware procurements required before the start of Phase C/D) must be clearly identified and discussed.

4. Risk Management. This section must describe the approach to, and plans for, risk management to be taken by the team, both in the overall mission design and in the individual systems and subsystems. Plans for using standard risk management tools, especially fault tree analysis, probabilistic risk assessments, and failure modes and effects analyses, must be described. A preliminary risk assessment must be performed which identifies the major technical, programmatic and budget risks associated with the instrument development. The top 3 to 5 risks and their mitigation plans must be discussed. Particular emphasis must be placed on describing how the various elements of risk, including new technologies used, will be managed to ensure successful accomplishment of the mission within cost and schedule constraints. Investigations dependent on new technology will be penalized for risk if adequate plans to ensure success of the investigation are not described.

   A summary of reserves in cost and schedule must be identified by Phase and project element and year and the rationale for them discussed. The specific means by which integrated costs, schedule, and technical performance will be tracked and managed must be defined. Specific reserves and the timing of their application must be described. Management of the reserves and margins, including who in the management organization manages the reserves and when and how the reserves are released, must be discussed. This must include the strategy for maintaining reserves as a function of cost-to-completion. All funded schedule margins must be identified. The relationship between the use of such reserves, margins, potential descope options, and their effect on cost, schedule, and performance must be fully discussed. When considering potential descope options, consider the investigation as a total system including instrument(s), ground system, and operations.

5. Government Furnished Property, Services, Facilities, etc. This section must clearly delineate the Government-furnished property, services, facilities, etc. required to accomplish all phases of the investigation.

6. Reviews. This section must list the major project reviews expected to be conducted during the project's life cycle and the approximate time frame of each. The objective of each review must be indicated. The formal review program covering mandatory reviews is described in the Geospace Mission Assurance Requirements (MAR). Allowance must also be made for government-initiated independent assessment reviews, such as Confirmation Assessments, Independent Annual Reviews and Red Team Reviews. This section should also describe the peer review process to be implemented by the instrument team.

7. Reporting. This section must clearly describe the approach to reporting progress to the Government and indicate the progress reviews the Government is invited to attend to provide independent oversight. The process, including the individual or organization

responsible for reporting integrated cost, schedule, and technical performance must be discussed. A description of the information to be presented must be included. Planned project status reporting must include quarterly presentations to the governing Program Management Council (PMC), monthly status reporting to the GSFC Program Office, and after the Project Critical Design Review (CDR), a brief weekly summary of progress via a web-based NASA Science Mission Directorate reporting site.

H. EDUCATION AND PUBLIC OUTREACH AND SMALL DISADVANTAGED BUSINESS PLAN

1. Education and Public Outreach. SMD is committed to fostering the broad involvement of the Space and Earth science research communities in Education and Public Outreach (E/PO) with the goal of enhancing the nation's formal education system and contributing to the broad public understanding of science, mathematics, and technology. Progress towards achieving this goal has become an important part of the broad justification for the public support of Earth and Space science. SMD sponsors a broad spectrum of educational activities ranging from kindergarten to postgraduate levels via several vehicles of solicitation.

   Every CSR must contain an E/PO statement of commitment. However, E/PO will not be an evaluation factor in the selection process for the mission of opportunity investigations. Proposers are welcome to provide a brief discussion of any unique characteristics of their investigation that might provide unusual opportunities for E/PO.

2. Small Disadvantaged Businesses and Minority Institutions. A summary plan is required specifying the proposed investigation's commitment to meet NASA's SDB and other minority institution participation goals as described in Section XIII of Appendix A of the AO. In addition, as also specified in Appendix A of the AO, subcontracting plans will be required to execute the contract option for investigation implementation. Phase A funds can no longer be used to develop SDB subcontracting plans. Reimbursement for SDB subcontracting plans can only be as an indirect, so-called bid and proposal, cost.

I. TECHNICAL DEFINITION (PHASE B) PLAN

This section must describe the plans and products for the technical definition phase (Phase B) of the Project. The key investigation tradeoffs and options to be investigated during the Phase B must be identified. This section must identify those issues, technologies, and decision points critical to mission success. These plans must include a detailed schedule and define the products (including a Project Plan) and the schedule for their delivery.

J. COST PLAN

The cost plan must provide information on the incurred Phase A cost and anticipated costs for phases B through E for the realistic launch date. A detailed cost proposal is required for Phase B/C/D. Cost estimates are required for Phase E, including a full description of the

estimating techniques used to develop the cost estimates. A clear and detail discussion of the basis of estimate must be provided with an explanation of heritage and commonality with other projects. Quantify and explain any cost savings that result from heritage. All costs, including all contributions made to the investigation, must be included. Proposers must complete a summary of total mission cost by fiscal year as shown in **Figure 1,** Total Investigation Cost Funding Profile. The purpose of this summary is to present all costs for the project *on one page,* by project phase (A through E), by participating organization, and by fiscal year. If obligation authority in excess of identified costs is required, the proposal must also indicate the authority needed by year. (Note: "fiscal year" shall be interpreted to be Government Fiscal Year throughout this document unless specified otherwise.)

In addition, for each phase of the investigation (B/C/D, and E) a Time Phased Cost Breakdown for each Work Breakdown Structure (WBS) element, as shown in **Figure 2**, must be completed. Use only the line items shown in Figure 2 that are relevant for each phase of the project. The purpose of this set of Figures is to provide detailed insight into how the project allocates funding during each phase of work.

The cost of the entire project must be summarized (on one page if possible), and presented in the format shown in **Figure 3**. The purpose of Figure 3 is to (1) provide detailed insight into project costs by cost element and (2) provide a basis for comparison of the project proposed cost with the evaluation team's independent cost analysis. Identify each reserve amount to the lowest level consistent with the proposed reserve management strategy. For example, if each subsystem manager will have spending authority over a reserve for the subsystem, each such amount must be identified separately. If more convenient, the reserve details may be shown in a separate table, with totals reported as shown in Figure 3. Show costs for all development elements by recurring and non-recurring components in the format of **Figure 4**. Show costs (NASA SMD and contributed) associated with each Co-Investigator in the format of **Figure 5**. All co-investigators must be included in Figure 5. Note that all contributions, including Co-I support, must be documented by Letter of Endorsements. Proposer must also provide a detailed cost breakout organized by their project –specific WBS as part of the cost plan.

Proposers must include all contributions provided by non-SMD and SMD programs at NASA Centers, including Civil Servant services, as well as the cost for the use of Government facilities and equipment on a full-cost accounting basis. All direct costs associated with the work performed at NASA Centers must be fully costed and accounted for in the proposal and summarized using the template provided in **Figure 6**. NASA Center Management and Operations (M&O previously known as Center G&A, IT, and facility service pools) and Independent Technical Authority (ITA) estimates need to be included, and separately identified using the center's out-year rate projection.

The purpose of this data is twofold: 1) to determine those costs that are included in the NASA SMD cost but are not funded out of the LWS Geospace program, and 2) to determine civil service contributions that are not included in the NASA SMD cost. Teams should work with their respective NASA Centers to develop estimates for these costs.

Note that the definitions for cost element terms shown in the cost figures are given in Appendix A of this document. This is not to be confused with the elements of cost listed in 1.e below.

The inflation index provided in Appendix B (Table B8) of the AO must be used to calculate all real-year dollar amounts, unless an industry forward pricing rate is used. If something other than the provided inflation index is used, the rates used must be documented.

All costs shall include all burdens and profit/fee in real-year dollars by fiscal year, assuming the inflation rates used by NASA (provided above) or specifically identified industry forward pricing rates.

1. Definition, Design, and Development (Phase B/C/D) Cost Proposal. This section provides a detailed cost proposal for performing Phase B/C/D. The cost proposal should clearly correlate with the plans set forth in the Science, Technical Approach. Schedule, and Management sections of the concept study

    a. Work Breakdown Structure. A Work Breakdown Structure (WBS) must be included for Phase B/C/D. The structure of the WBS should be consistent with the plans set forth in the Technical Approach and Management sections of the concept study and the Statement of Work provided as an Appendix to the concept study. The WBS shall be described to the major component level for more complicated instruments. All other elements of the WBS must be at least to the major task level (e.g., Project Management, Systems Engineering, Ground Support Equipment).

    b. Workforce Staffing Plan. Provide a workforce staffing plan which is consistent with the Work Breakdown Structure. This workforce staffing plan must include all team member organizations and must cover all management, technical (scientific and engineering), and support staff. The workforce staffing plan must be phased by fiscal year. Time commitments for the Principal Investigator, Project Manager, Co-Investigators, and other key personnel must be clearly shown.

    c. Proposal Pricing Technique. Describe the process and techniques used to develop the Phase B/C/D cost proposal. For portions of the cost proposal developed using a grass-roots methodology, provide the bases from which the estimates were derived and details on how the estimates were extrapolated from the bases. For portions of the cost proposal derived from vendor quotes/historical actuals/catalogue prices/etc. include sufficient information to understand the fidelity of the values. For portions of cost the proposal derived from analogies, describe the value of and the methodology for extrapolating the analogy. For portions of the cost proposal derived parametrically, provide a description of the cost-estimating model(s) and techniques used in the Phase B/C/D cost estimate. Discuss the heritage of the models and/or techniques applied to this estimate, including any known differences between instruments contained in the model's data base and key attributes of the proposed

instrument. Include the assumptions used as the basis for the Phase B/C/D cost and identify those which are critical to cost sensitivity in the investigation. If any "discounts" were assumed in the cost estimates for producing multiple copies of identical instruments, business practice initiatives or streamlined technical approaches, describe how these have been incorporated in the cost estimate and will be managed by the investigation team.

d. Phase B/C/D Time-Phased Cost Summary. Provide a summary of the total Phase B/C/D costs consistent with Figure 2. The Phase B/C/D cost summary should be developed consistent with the Work Breakdown Structure and must include all costs to NASA SMD along with all contributed costs. The Phase B/C/D time phased cost summary must be phased by fiscal year.

e. Elements of Cost Breakdown. To effectively evaluate the Phase B/C/D cost proposals, NASA requires cost or pricing data as defined in FAR 15.401 and supporting evidence stating the basis for the estimated costs by the WBS levels used in Figure 2. This information is in addition to that provided in Figures 1 through 6. Provide Tables for each phase in the format in **Figure 7A**. The proposal will include, but is not limited to the following elements of cost:

   i. Direct Labor.
      (1) Explain the basis of labor-hour estimates for each of the labor classifications.
      (2) State the number of productive work-hours per month.
      (3) Provide a schedule of the direct labor rates used in the proposal. Discuss the basis for developing the proposed direct labor rates for the team member organizations involved; the forward-pricing method (including midpoint, escalation factors, anticipated impact of future union contracts, etc.); and elements included in the rates, such as overtime, shift differential, incentives, allowances, etc.
      (4) If available, submit evidence of Government approval of direct labor rates for proposal purposes for each labor classification for the proposed performance period.
      (5) If Civil Servant labor is to be used in support of the Phase B/C/D study, but is not to be charged directly to the investigation, then this labor must be considered as a contribution by a domestic partner, subject to the same restrictions as other contributions by domestic or foreign partners. A discussion of the source of funding for the Civil Servant contributions must be provided.
   ii. Direct Material. Submit a summary of material and parts costs for each element of the WBS.
   iii. Subcontracts. Identify fully each effort (task, item, etc. by WBS element) to be subcontracted, and list the selected or potential subcontractors, locations, amount budgeted/proposed, and types of contracts. Explain the adjustments, if any, and the indirect rates (or burdens) applied to the subcontractors' proposed amounts anticipated. Describe fully the cost analysis or price analysis and the negotiations

conducted regarding the proposed subcontracts. Phase A funds can no longer be used to develop subcontracting plans. Reimbursement for subcontracting plans can only be as an indirect, so-called bid and proposal, cost.

iv. Other Direct Costs.

(1) Travel, Relocation, and Related Costs. Provide a summary of the travel and relocation costs including the number of trips, duration, and purpose of the trips.

(2) Computer. Provide a summary of all unique computer-related costs.

(3) Consultants. Indicate the specific task area or problem requiring consultant services. Identify the proposed consultants, and state the quoted daily rate, the estimated number of days, and associated costs (such as travel), if any. State whether the consultant has been compensated at the quoted rate for similar services performed in connection with Government contracts.

(4) Other. Explain and support any other direct costs included in the Phase B/C/D proposal in a manner similar to that described above.

v. Indirect Costs.

(1) List all indirect expense rates for the team member organizations. Indirect expense rates include labor overhead, material overhead, general and administrative (G&A) expenses, and any other cost proposed as an allocation to the proposed direct costs.

(2) If the proposal includes support services for which off-site burden rates are used, provide a schedule of the off-site burden rates. Include a copy of the company policy regarding off-site vs. on-site effort.

(3) If available, submit evidence of Government approval of any/all projected indirect rates for the proposed period of performance. Indicate the status of rate negotiations with the cognizant Government agency, and provide a comparative listing of approved bidding rates and negotiated actual rates for the past five (5) fiscal years.

(4) Discuss the fee arrangements for the major team partners.

2. Science Operations and Data Analysis (Phase E) Cost Estimate. This section provides a cost estimate for performing the Science Operations and Data Analysis Phase (Phase E) portion of the mission. The Phase E cost estimates should correlate with the plans set forth in the Science, Technical Approach, Schedule, and Management sections. In completing this section, the following guidelines will apply:

a. Work Breakdown Structure. A Work Breakdown Structure (WBS) must be included for the Science Operations and Data Analysis Phase of the mission. The WBS should be consistent with the plans set forth in the Technical Approach and Management sections and the Statement of Work that is provided as an Appendix.

b. Cost Estimating Technique. Describe the process and techniques used to develop the Phase E cost estimate. For portions of the cost proposal developed using a grass-roots methodology, provide the bases from which the estimates were derived and details on how the estimates were extrapolated from the bases. For portions of the

cost proposal derived from vendor quotes/historical actuals/catalogue prices/etc. include sufficient information to understand the fidelity of the values. For portions of cost the proposal derived from analogies, describe the value of and the methodology for extrapolating the analogy. For portions of the cost proposal derived parametrically, provide a description of the cost-estimating model(s) and techniques used in your Phase E cost estimate. Discuss the heritage of the models applied to this estimate including any known differences between instruments contained in the model's database and key attributes of the proposed instruments. Include the assumptions used as the basis for the Phase E cost and identify those which are critical to cost sensitivity in the investigation. If any "discounts" were assumed in the cost estimates for operating multiple identical instruments, business practice initiatives or streamlined technical approaches, describe how these have been incorporated in the cost estimate and will be managed by the investigation team.

c. Workforce Staffing Plan. Provide a workforce staffing plan (including civil service) which is consistent with the Work Breakdown Structure. This workforce staffing plan must include all team member organizations and must cover all management, manufacturing, technical (scientific and engineering), and support staff. The workforce staffing plan must be phased by fiscal year. Time commitments for the Principal Investigator, Co-Investigators, Project Manager, and other key personnel must be clearly shown.

d. Phase E Time-Phased Cost Summary. Provide a summary of the total Phase E costs consistent with Figure 2. The Phase E cost summary should be developed consistent with the Work Breakdown Structure and must include all costs to NASA SMD, along with all contributed costs. The Phase E time phased cost summary must be phased by fiscal year.

e. Elements of Cost Break Down. Provide cost or pricing data as defined in FAR 15.401 and supporting evidence stating the basis for the estimated cost including but not limited to the elements of cost described under section K.1.e above.

3. Total Investigation Cost Estimate. This section must summarize the estimated costs to be incurred in Phases A through E including: Concept Study (Phase A), Technical Definition (Phase B); Design and Development Phase (Phase C/D); Science Operations and Data Analysis Phase (Phase E); and other ground system costs; and cost of activities associated with social or educational benefits (if not incorporated in any of Phases A through E). Figure 1 must be used to summarize these costs. The total investigation cost estimate should be developed consistent with the Work Breakdown Structure. Detailed plans for any aspects of the mission not discussed elsewhere in the CSR must be discussed here. The funding profile must be optimized for the mission. Contributions not included in the NASA SMD cost must be clearly identified as separate line items.

4. Total E/PO Cost Estimate: This section must summarize the estimated costs to be incurred in Phases A through E of the investigation for the E/PO component. This summary should be consistent with and relate directly to the top-level E/PO budget lines

in Figures 1 through 6 as appropriate and describe how these costs relate to the activities, products, programs, partnership arrangements, etc., defined in Section H.

FIGURE 1

TOTAL INVESTIGATION COST FUNDING PROFILE TEMPLATE

(FY costs* in Real Year Dollars, Totals in Real Year and FY 2007 Dollars)

Item	FY070	FY08	FY09	FY10	FY11	…	FY15	Total (Real Yr.)	Total (FY 2007)
Phase A	$	$	$	$	$	$	$	$	$
- Organization A									
- Organization B									
- etc.									
Phase B	$	$	$	$	$	$	$	$	$
- Organization A									
Phase C/D	$	$	$	$	$	$	$	$	$
- Organization A									
Phase E									
- Organization A									
E/PO	$	$	$	$	$	$	$	$	$
Other (specify)	$	$	$	$	$	$	$	$	$
NASA SMD Investigation Cost	$	$	$	$	$	$	$	$	$
Contributions by Organization (Non-U.S. or U.S.) to:									
Phase A	$	$	$	$	$	$	$	$	$
- Organization A									
Phase B	$	$	$	$	$	$	$	$	$
- Organization A									
Phase C/D	$	$	$	$	$	$	$	$	$
- Organization A									
Phase E									
- Organization A									
E/PO	$	$	$	$	$	$	$	$	$
Other (specify)	$	$	$	$	$	$	$	$	$
Contributed Costs (Total)	$	$	$	$	$	$	$	$	$
						Investigation Totals		$	$

* Costs must include all costs including fee

FIGURE 2
(Time Phased costs in Real Year Dollars, Totals in Real Year and FY2007 Dollars)

TIME PHASED COST BREAKDOWN BY WBS AND MAJOR COST CATEGORY					
WBS/Cost Category Description	FY07	FY08	• • •	Total (RY$)	Total (FY2007$)
Total Direct Labor Cost	$	$	$	$	$
WBS 1.0 Management					
WBS 2.0 Instrument 1					
Lower-level WBS elements for Instrument 1					
etc.					
Total Subcontract Costs	$	$	$	$	$
WBS # and Description					
:					
etc.					
Total Materials & Equipment Cost	$	$	$	$	$
WBS # and Description					
:					
etc.					
Total Reserves	$	$	$	$	$
WBS # and Description					
:					
etc.					
Total Other Costs	$	$	$	$	$
WBS # and Description					
:					
etc.					
Fee					
E/PO					
Other (Specify)					
Total Contract Cost	$	$	$	$	$
Total Other Costs to NASA SMD	$	$	$	$	$
Ground Segment					
E/PO					
Other (Specify)					
Total Contributions (Non-U.S. or U.S.)	$	$	$	$	$
Organization A:					
WBS # and Description					
etc.					
Organization B:					
WBS # and Description					
etc.					
TOTAL COST FOR PHASE	$	$	$	$	$

Figure 3

Fiscal Year Costs in Real Year Dollars (to nearest thousand)

(Totals in Real Year and Fiscal Year 2007 Dollars)

Cost Element	FY1	FY2	FY3	...	FYn	Total (RY$)	Total (FY2007$)
Phase A							
Reserves							
Total Phase A							
Phase B							
Reserves							
Total Phase B							
Phases C and D							
Instrument A							
Instrument B							
Instr Integ, Assy & Test							
Subtotal - Instruments							
Proj Mgmt/Miss Analysis/Sys Eng/Miss Assurance							
Science Team Support							
Prelaunch GDS/MOS Development							
E/PO, Other*							
Subtotal before Reserves							
Instrument Reserves							
Other Reserves							
Total Phases C and D							
Phase E							
MO&DA							
E/PO, Other*							
Subtotal Phase E before Reserves							
Reserves							
Total Phase E							
Total NASA SMD Cost	$	$	$	$	$	$	$
Contributions*							
Total Contributions	$	$	$	$	$	$	$
				Total Investigation Cost			$

*Specify each item on a separate line; include Education & Public Outreach, facilities, etc.

Figure 4
Phase B/C/D Development Costs
in Real Year Dollars (to nearest thousand)

Cost Element	Non-Recurring	Recurring	Total (RY$)	Total (FY2007$)
Instrument A*				
Instrument B*				
Instrument n*				
Subtotal - Instruments				
Any other elements (specify)				
Subtotal - Other elements				
Total NASA SMD Development Cost				

* Specify each instrument by subsystem/components where possible

FIGURE 5
CO-INVESTIGATOR COMMITMENT AND COST
FUNDING PROFILE TEMPLATE
(Phase costs in Real Year Dollars, Totals in Real Year and FY2007 Dollars)

	Phase B	Phase C/D	Phase E	Total (Real Year)	Total (FY 2007)
NASA SMD Cost					
Co-I # 1 Name/Organization					
Percent Time					
Cost					
Co-I #2 Name/Organization					
Percent Time					
Cost					
Co-I #n Name/Organization					
Percent Time					
Cost					
Total NASA SMD Co-I Cost					
Contributions					
Co-I # 1 Name/Organization					
Percent Time					
Cost					
Co-I #2 Name/Organization					
Percent Time					
Cost					
Co-I #n Name/Organization					
Percent Time					
Cost					
Total Contributed Co-I Cost					

FIGURE 6
NASA CIVIL SERVICE COSTS
FUNDING PROFILE TEMPLATE
(FY costs in Real Year Dollars, Totals in Real Year and FY2007 Dollars)

Item	FY07	FY08	FY09	FY10	FY11	…	FY13	Total (Real Yr.)	Total (FY 2007)
Workforce	$	$	$	$	$	$	$	$	$
- NASA Center A									
- NASA Center B									
- etc.									
Facilities	$	$	$	$	$	$	$	$	$
- NASA Center A									
E/PO,Other*	$	$	$	$	$	$	$	$	$
- NASA Center A									
M&O and ITA									
- NASA Center A									
- NASA Center B									
NASA Civil Service Costs included in NASA SMD Cost	$	$	$	$	$	$	$	$	$
Contributions by NASA Centers									
Workforce	$	$	$	$	$	$	$	$	$
- NASA Center A									
- NASA Center B	$	$	$	$	$	$	$	$	$
- etc.	$	$	$	$	$	$	$	$	$
Facilities									
- NASA Center A									
E/PO, Other*									
- NASA Center A									
M&O and ITA									
- NASA Center A									
- NASA Center B									
Contributed NASA Civil Service costs	$	$	$	$	$	$	$	$	$
						Investigation Totals			$

*Specify each item on a separate line.

Figure 7a Summary Of Elements Of Costs ($K) (See Instructions)

Real Year Dollars

WBS #/Title: _____

Check One: _____PHASE B _____PHASE C/D _____ PHASE E

	FY07	FY08	FY09	FY10	FYn	Total
Direct Labor Hrs: (By skill categories)						
Direct Labor Cost: (by skill categories)						
Total Direct Labor Costs						
Overhead (by cost Centers)						
Other Direct Costs						
Subcontracts						
Materials						
Material Burdens						
Travel						
Other Direct Costs						
Subtotal						
G & A Expense (by cost pools)						
Subtotal						
Cost of Money (by direct pools & overhead centers)						
Profit/Fee						
Total Cost Plus Fee						

Figure 7b Cost Table Instructions For Figure 7a

The Summary of Elements of Cost and Basis of Estimate for Phase B, C/D and E should contain the following direct and indirect elements, as applicable:

- DIRECT LABOR HOURS – Show productive hours by individual skill categories.

- DIRECT LABOR COSTS – The labor costs should be itemized by skill categories. The basis for the rates should be described. Provide a schedule of the direct labor rates used in the proposal. Discuss the basis for developing the proposed direct labor rates for the team member organizations involved; the forward-pricing method (including midpoint, escalation factors, anticipated impact of future union contracts, etc.); and elements included in the rates, such as overtime, shift differential, incentives, allowances, etc. If available, submit evidence of Government approval of direct labor rates for proposal purposes for each labor classification for the proposed performance period. If Civil Servant labor is to be used in support of a phase, but is not to be charged directly to the investigation, then this labor must be considered as a contribution by a domestic partner, subject to the same restrictions as other contributions by domestic or foreign partners. A discussion of the source of funding for the Civil Servant contributions must be provided.

- LABOR OVERHEAD – Overhead should be itemized by overhead cost centers (engineering, manufacturing, etc.) as well as associated rates.

- SUBCONTRACTS – Identify fully each effort (task, item, etc. by WBS element) to be subcontracted, and list the selected or potential subcontractors, locations, amount proposed, and types of contracts.) Explain the adjustments, if any, and the indirect rates (or burdens) applied to the subcontractors' proposed amounts anticipated. Describe fully the cost analysis or price analysis and the negotiations conducted regarding the proposed subcontracts. Note that during the negotiation of any contract award, the Government reserves the right to obtain the same level of detail as requested from the proposer.
- MATERIALS – Provide supporting details for major vendors. Burden rates must be identified.

- TRAVEL – Provide supporting details for destination, purpose, number of people per trip, transportation costs, per diem costs, and miscellaneous costs.

- OTHER DIRECT COSTS – Identify cost and purpose.

- GENERAL AND ADMINISTRATIVE (G&A) EXPENSE – G&A expense represents the institution's general and executive offices and other miscellaneous expenses related to

business. G&A expense should be itemized by cost pool, and rates should be documented.

- COST OF MONEY (COM) – COM represents interest on borrowed funds invested in facilities. COM should be itemized by indirect pools and overhead centers. Rates should be documented.

- PROFIT/FEE – Document the basis, rate, and amount of fee. Document the fee arrangements for the major team partners.

- ESCALATION FACTORS – document the escalation factors used to determine real year dollars.

Figure 8

MASTER EQUIPMENT LIST Template - Items shown are for example purposes only

			# of Units				Flight Hardware Summary			Other Component Information	
ubsystem	Component	Unit Mass, Current Best Estimate (CBE)	Flight Units	Flight Spares	Engrng Models	Proto-types	Total Mass, CBE	Contingency %	Total Mass w/ Contingency	Description (Vendor, Part #, Heritage Basis)	Other characteristics/issues (volume, power, other component-specific items)
nstruments/Payload											
Instrument 1 (separate breakout for each instrument)	Structures										
	Mechanisms										
	MLI										
	Radiators										
	Cryocoolers										
	Heat pipes										
	Optics										
	Focal Plane - Detectors										
	Focal Plane - R/O Electr										
	Cmd & Cntrl Electr										
	Others										

K. APPENDICES

The following additional information is required to be supplied with the CSR. This information can be included as Appendices to the CSR, and, as such, will not be counted within the specified page limit.

1. Letters of Endorsement. Letters of endorsement must be provided from all organizations participating in and critical to the investigation. This requirement also applies to all organizations making contributions. Letters of endorsement must be signed by both the lead representative from each organization represented on the team, and by institutional and Government officials authorized to commit their organizations to participation in the proposed investigation. If government funding is required to support a contribution, a letter of support or commitment is required from the government funding agency, signed by an official authorized to commit the agency. Signed letters of support or commitment must be provided from all E/PO partners or subcontractors detailing their commitment to or involvement in the E/PO effort. Institutional letters of endorsement for all Co-Investigators are required as part of the Phase A concept study report.

2. Relevant Experience and Past Performance. Proposals must include a discussion of relevant experience and past performance by the major team partners in meeting the requirements of projects similar to the subject of this CSR. For this part of the CSR, we are seeking information about the partner organizations rather than individuals. Projects that ended more than 5 years ago need not be included in the discussion. The discussion of relevant experience and past performance must include a description of each project; its relevance to the subject of the CSR; the proposed performance and the actual performance; the proposed cost and actual cost; the proposed schedule and actual schedule; an explanation of any differences between proposed performance, cost and schedule and what was actually achieved; and points of contact for the past project's customer. If the customer for the past project was the United States government, then the contract number must be included along with current technical point(s) of contact and phone number(s). For projects that are not yet complete, the current projected performance, cost, and schedule must be used in place of actual values.

   In evaluating the CSR, NASA will consider the past performance of the major partner organizations. The evaluation of past performance will not be arithmetic; instead, the information deemed to be most relevant and significant will receive the greatest consideration. Relevant experience will be viewed as the demonstrated accomplishment of work, which is comparable or related to the objectives of the CSR. In conducting the evaluation, NASA reserves the right to use all information available.

   The team is cautioned that omissions or an inaccurate or inadequate response to this evaluation item will have a negative effect on the overall evaluation, and while NASA may consider data from other sources, the burden of providing relevant references that NASA can readily contact rests with the team.

3. Resumes. Provide resumes for all key personnel identified in the Management section. Include resume data on experience that relates to the job these personnel will be doing for the proposed investigation.

4. Statements of Work for each Contract Option. Provide draft Statement(s) of Work for all potential contracts with NASA. These Statement(s) of Work must (as a minimum) be for each contract option (i.e., Phase B/C/D, and Phase E) and clearly define all proposed deliverables (including science data) for each option, potential requirements for Government facilities and/or Government services, and a proposed schedule for the entire mission.

5. Data Management Plan. A draft Data Management Plan is required.

6. Incentive Plan(s). Draft Incentive Plans (if applicable) must be included with the concept study. Incentive Plans must outline contractual incentive features for all major team members. Incentive Plans must include both performance and cost incentives, as appropriate.

7. NASA PI Proposing Teams. The same guidelines as in AO Appendix B apply.

8. Technical Content of any International Agreement(s). Draft language for the technical content of any International Agreement(s) are required for all non-U.S. partners in the investigation. A sample agreement is available in the LWS Geospace Program Library. The draft language must include (i) a brief summary of the mission and the foreign partner's role in it, (ii) a list of NASA's responsibilities within the partnership, and (iii) a list of the non-U.S. partner's responsibilities in within the partnership. Note that NASA prefers to establish agreements with government funding agencies, not with the institution which will be funded to perform the work.

9. Discussion on Compliance with U.S. Export Laws and Regulations. Provide an update to the discussion in the proposal. Investigations that include international participation, either through involvement of non-U.S. nationals and/or involvement of non-U.S. entities must include a section discussing compliance with U.S. export laws and regulations; e.g., 22 CFR 120-130, *et seq*. and 15 CFR 730-774, *et seq*., as applicable to the scenario surrounding the particular international participation. The discussion must describe in detail the proposed international participation and is to include, but not be limited to, whether or not the international participation may require the proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available through Internet URLs http://www.pmdtc.org and http://www.bxa.doc.gov. Proposers are advised that under U.S. law and regulation, spacecraft and their specifically designed, modified or configured systems, components, parts, etc., such as the instrumentation being sought

under this AO, are generally considered "Defense Articles" on the United States Munitions List and are therefore subject to the provisions of the International Traffic in Arms Regulations, 22 CFR 120-130, *et seq*.

10. Science Level 1 Requirement. The Science Level 1 Requirements must be provided. Examples of Science Level 1 Requirements are found in Section 4.2 of the Program Level Requirements for the Phoenix Lander and in Section 4.1 of the Program Level Requirements for WISE. The Program Level Requirements for the Phoenix Lander and WISE are provided in the RBSP Mission Acquisition online library (http://sso.larc.nasa.gov/rbsp/rbsplib.html). The Level 1 Requirements for the mission must be explicitly described, and these must be linked to the scientific objectives of the mission. The requirements that these objectives and observations impose on the mission design elements must be discussed. The proposer must provide the science requirements to meet the full mission success criteria and the minimum mission success criteria.

11. Acronyms List.

12. References List (Optional) Concept studies may provide, as an appendix, a list of reference documents and materials used in the concept study. The documents and materials themselves cannot be submitted, except as a part of the concept study.

Introduction

This is a short dictionary of definitions for the cost elements shown in the figures and tables and discussed in the body of this *Criteria and Guidelines for Concept Study* document.

Project Management/Systems Engineering

Project management costs include all efforts associated with project level planning and directing of prime and subcontractor efforts and interactions, as well as project-level functions such as quality control and product assurance. Systems engineering is the engineering required to ensure that all instrument subsystems function properly to achieve mission goals and requirements. This cost element also includes the data/report generation activities required to produce internal and deliverable documentation.

Instruments

Instrument costs include costs incurred to design, develop and fabricate the individual scientific instruments or instrument systems through delivery of the instruments to the spacecraft for integration. Costs for instrument integration, assembly, test, and ground support equipment are to be shown separately from instrument development. Costs incurred for integration of the instruments to the spacecraft are included in the Spacecraft Integration, Assembly & Test cost element (see below).

Spacecraft Integration, Assembly & Test (IA&T)

S/C integration, assembly and test is the process of integrating all spacecraft subsystems and payloads into a fully tested, operational satellite system. The total cost of IA&T for a satellite includes research/requirements specification, design and scheduling analysis of IA&T procedures, ground support equipment, systems test and evaluation, and test data analyses. Typical satellite system tests include thermal vacuum, thermal cycle, electrical and mechanical functional, acoustic, vibration, electromagnetic compatibility/interference, and pyroshock. This element encompasses only the support required from the instrument to support observatory IA&T. The spacecraft vendor will provide facilities and support personnel for the spacecraft element of the observatory IA&T

Launch Checkout & Orbital Operations
Launch checkout and orbital operations support costs are those involving pre-launch planning, launch site support, and the first 90 days of flight operations.

Pre-Launch Science Team Support
Includes all Phase B/C/D (pre-launch) support costs for the science team. (See below for post-launch component.)

Pre-Launch GDS/Mission Operations Services (MOS) Development
Includes costs associated with development and acquisition of the ground infrastructure used to process science data. Includes development of science data processing and analysis capability. Also includes pre-launch training of the science team, support for the development and execution of operations simulations, sequence development, and flight control software. It may be assumed that data and commanding will be provided via links between the instrument operations control center and the mission operations center.

Instrument Operations
Instrument operations comprise all activities required to plan and execute the science objectives, including instrument control, health monitoring, and calibration. Costs include all post-launch costs for people, procedures, services, hardware and software to carry out these activities.

Data Analysis (DA)
This cost element refers only to Phase E (after launch plus 30 days), and must not include costs of any proposed extended mission, Participating Scientist Program (PSP), or Data Analysis Program (DAP). Data analysis activities include collecting, processing, distributing and archiving the scientific data in the appropriate data archive. Costs include all post-launch budgets for people, procedures, services, hardware and software to carry out these activities. Includes science team support budgets post-launch.

Education and Public Outreach
Includes all costs associated with developing and implementing the proposed project's programs for education and public outreach.

Project-Unique Facilities
If the proposed project requires construction or lease of any ground facilities, include here only the portion of costs to be borne by the proposed project, with description of the nature and extent of any cost-sharing arrangements assumed.

Reserves

The proposer must include sufficient budget reserve such that all instrument issues can be accommodated and resolved within the total budget proposed. The project will not hold any reserves to handle any instrument development and integration issues. The project will only hold reserve to accommodate impacts to the instrument caused by changes outside control of the instrument such as a change in resources cause be a change in launch vehicle.

Reserves must be adequate to mitigate contingencies or underestimation of resources. Reserves must be reported according to the proposed reserve management strategy.

NASA Center Costs (all categories)

Additional costs borne by the project for NASA Center participation. For example, there may be additional project management/systems engineering costs, above those incurred by the instrument prime contractor, which are due to NASA employee participation. These costs must be reported on a full-cost accounting basis.